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COMMENTS ON THE *UNDULATA* GROUP OF *AMEIVA* (SAURIA).

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In a recent paper Dunn[1] has clarified the nomenclature of the lower Central American Ameivas. Of the various species discussed *Ameiva leptophrys* Cope is the only one which falls within the difficult *undulata* complex so common in northern Central America. This group, through the investigations of Smith[2] and Hartweg and Oliver,[3] had begun to sort out into closely related, though quite distinct, populations. Just as the entire problem seemed well in hand, however, I collected in the semi-arid Cahabón Valley of the Alta Verapaz, a series of specimens which throws the situation into worse than its former confusion. Before discussing the problem further I present the following description of this population which is taxonomically distinct:

Ameiva chaitzami, sp. nov.[4]

Holotype.—An adult male, University of Michigan, Museum of Zoology No. 90368. Collected April 15, 1940, by L. C. Stuart.

Type locality.—Along Cahabón-Lanquín trail about 2 km. north of Finca Canihor (about 38 km. E N E [straight line] of Cobán, Alta Verapaz, Guatemala).

Diagnosis.—An *Ameiva* almost identical with *Ameiva undulata stuarti* Smith from which it may readily be distinguished by the fact that the median parietal is divided longitudinally to produce four instead of three parietals.

1 Dunn, E. R., New and Noteworthy Herpetological Material from Panama, Proc. Acad. Nat. Sci. Phila., 92, 1940: 113–115.

2 Smith, Hobart M., Descriptions of New Lizards and Snakes from Mexico and Guatemala, Proc. Biol. Soc. Wash., 53, 1940: 55–56.

3 Hartweg, Norman and Oliver, James, A Contribution to the Herpetology of the Isthmus of Tehuantepec II. The Teiids of the Pacific Slope, Occ. Pap. Mus. Zool., Univ. Mich., 359, 1937: 7–8.

4 Dedicated to Chaitzam, the mountain lord who dominates the lower Cahabón Valley.

Description of holotype.—Rostral moderately narrow, followed by anterior nasals which contact each other mid-dorsally. Frontonasal single; prefrontals contacting postnasals laterally, thus separating frontonasal from loreals. Frontal large, almost hexagonal; 2 frontoparietals and 4 parietals followed by several slightly-enlarged, irregularly-arranged plates which end abruptly at the nape. Supraoculars 4/3, the first completely and the second partially in contact with the supraciliaries; posterior supraoculars separated from the superciliaries by a single row of granules. Posterior portion of third supraocular on one side and entire fourth on the other side separated from frontoparietals by several small scales. Loreal large; 7 supralabials and 8 infralabials, the last three very narrow. Ear large. Eight longitudinal rows of abdominal scutes. Dorsal and lateral caudals keeled, ventral caudals smooth. One row of enlarged radials, 2 of enlarged humerals, 3 of femorals and 2 of tibials. Femoral pores, 16/17. Single median row of enlarged gulars surrounded by subequal granules; enlarged but irregularly arranged scutes on throat collar. Prenasals in 2 longitudinal rows.

Color in spirits.—Top of head and mid-dorsal area of body, olive brown. A dorsal lateral stripe of bluish white commencing at the posterior corner of the eye and extending posteriorly to about 1/3 the way back on the tail. This stripe bordered above by a black band whose medial edge is irregular. Below this white stripe is a broad black band beneath which lies a second light stripe commencing at the eye and extending posteriorly above the tympanum and continuing posteriorly onto the tail. This lower stripe is broken into spots above the axilla and is interrupted by the leg insertions. Ventro-laterally below the light stripe the body is black with a few irregular vertical bluish white bars. The legs and arms are olive brown above, mottled with black and bluish white. The anterior surfaces of the thighs are black with blue spots. The ventral surfaces are bluish, darkest on abdomen, and the sides of the head are blue mottled with black. The tail is brown above with a broken, mid-dorsal black stripe and laterally is marked with a continuation of the body stripes. Under surface of the tail brownish white.

Body measurements are as follows:

Head to occiput, 20 mm.	Fore limb to tip of digit IV, 23 mm.
Occiput to above anus, 50 mm.	Hind limb to heel, 24 mm.
Tail, 150 mm.	Heel to tip of digit IV, 28 mm.

Paratypes.—University of Michigan, Museum of Zoology Nos. 90639–43, collected within a few kilometers of the holotype.

Range.—Known only from the type locality but probably distributed throughout the savanna area of the semi-arid lower Cahabón Valley below about 1000 m. from Lanquín (30 km. [straight line] E N E from Cobán) to Taquincó (56 km. [straight line] E from Cobán).

Remarks.—The paratypic series is essentially like the holotype in all respects. A female with a head-body length of 66 mm. containing well formed eggs, thus indicating that this is a much smaller species than *stuarti* which it resembles closely. In habits I was unable to distinguish

this species from *A. u. hartwegi*, which was very abundant throughout the Cahabón Valley.

Relationships.—Any discussion of the relationships of *chaitzami* must include a survey of the various forms which comprise the *undulata* group. To allocate individuals of this group presents an almost hopeless task, yet when a series of specimens is considered, a collective population is not too difficult to name. Despite the tremendous individual variation and often broad areas of intergradation, definite races are, though possibly little more than incipient, plainly visible when viewed *in toto*.

As yet it is too early to do more than outline briefly the races which occur through Middle America, for there are still tremendous gaps in our data, and our collections are often too sporadically distributed to permit the interpretation of variations or to fix with certainty phylogenetic relationships. Notwithstanding these difficulties I am of the opinion that the *undulata* group presents a rather clear-cut complex of closely related forms, which, when all the material has finally been assembled and studied in detail, should produce a relatively simple taxonomic and geographic picture. In the following, however, I have made no attempt to study the variations critically, and my concept of the races is based for the most part upon familiarity gained through the mere handling of hundreds of specimens rather than upon detailed statistical analysis of the various characters

The following is a check list of the forms of the *undulata* group which I believe I can recognize:

Ameiva undulata undulata (Wiegmann).

Cnemidophorus undulatus, Wiegmann, Herpet. Mex. 1834: 27 (type locality, Mexico by inference; restricted to the Tehuantepec, Mexico, race by Smith, *op. cit.*: 56 and not by Hartweg and Oliver as stated by Smith.)

Range.—Pacific lowlands of Mexico from Tehuantepec to Colima, inclusively.

Remarks.—Specimens from Colima differ slightly from the Tehuantepec material, and I am of the opinion that when material is forthcoming from the intervening regions, a race will be named to include the populations along the Pacific coast west of Tehuantepec. For the present, however, I prefer to include the Colima material under typical *undulata* and extend its range along the Pacific lowlands, Tehuantepec through Colima.

Ameiva undulata parva Barbour and Noble.

Ameiva undulata parva, Barbour and Noble, Bull. Mus. Comp. Zool., 59, 6, 1915: 476 (type locality, Guatemala).

Range.—Along the Pacific slopes from Tehuantepec, Mexico, to Costa Rica.

Ameiva undulata hartwegi Smith.

Ameiva undulata hartwegi, Smith, Proc. Biol. Soc. Wash., 53, 1940: 55 (type locality, Chiapas, Mexico, across Rio Usumacinta from Piedras Negras Guatemala).

Range.—Caribbean lowlands from Campeche, Mexico to Honduras.

Ameiva undulata stuarti Smith.

Ameiva undulata stuarti, Smith, Proc. Biol. Soc. Wash., 53, 1940: 55 (type locality, Palenque, Chiapas, Mexico).

Range.—Lowlands of Caribbean Mexico from Tamaulipas to Campeche.

Ameiva undulata pulchra Hallowell.

Ameiva pulchra, Hallowell, Proc. Acad. Nat. Sci. Phila., 1860: 483 (type locality, Nicaragua).

Range.—Caribbean Honduras southward to Costa Rica.

Remarks.—Dunn (*loc. cit.*) does not indicate whether or not *parva* or *pulchra* meets *leptophrys* in Costa Rica nor does he express an opinion as to the status of *amivoides* of Cope (Proc. Acad. Nat. Sci. Phila., 1894: 198; type locality, La Carpintera, Costa Rica). He has informed me (*in litt.*), however, that, though he expects a Caribbean *undulata*, in Costa Rica none has as yet been discovered. He has recently discovered, moreover, two specimens from Pozo Azul de Pirris, Costa Rica, one of which is *leptophrys*, the other *parva*. Lacking other material, however, he hesitates to consider these specimens either as proof of overlapping between the two or as members of an intergrading population. He similarly informs me that *amivoides* may eventually be shown to be distinct from *parva* and be restricted to the central plateau of Costa Rica. It is possible that between *leptophrys* and *pulchra* there may be another race. Similarly *Ameiva festiva miadis* Barbour and Loveridge (Bull. Mus. Comp. Zool., 69, 7, 1929: 141; type locality, Great Corn Island) needs further study before it can be definitely allocated. Through material from southern Nicaragua and western Costa Rica an expression of the relationships between *parva*, *pulchra*, and *leptophrys* may be found. Lacking such material, the following form is accorded specific status entirely because of its greater degree of differentiation (see below).

Ameiva leptophrys (Cope).

Ameiva leptophrys, Cope, Proc. Amer. Phil. Soc., 31, 1893: 341 (type locality Buenos Ayres, Costa Rica).

Range.—"Entire Pacific coast from Darien on into Costa Rica as far as Buenos Ayres. Atlantic coast only in Canal Zone and Porto Bello. Up to 2000 feet at El Valle" (Dunn, *loc. cit.*).

Ameiva chaitzami Stuart (see above).

In diagnosing the above forms a number of characters prove useful but few are infallible and, for the most part, they can be applied only to populations rather than to individuals. The nature of the throat scales, whether abruptly enlarged medially or whether arranged in a single longitudinal row, offers an important taxonomic character. In *stuarti* and *chaitzami*, for instance, these scutes are almost consistently arranged in a single longitudinal series, but such an arrangement may occur also in *pulchra* and in the Colima population of *undulata*. A similar arrangement occurs in typical *undulata* but, though difficult to define the differ-

ences between the two, no one familiar with the two forms would ever confuse them.

The single series of preanals were found by Hartweg and Oliver (*loc. cit.*) to prove diagnostic of 92 per cent of the specimens of *undulata*, but this character is much less reliable in the diagnosis of the Colima population. In other forms there is a marked tendency towards a double row of preanals.

Smith (*loc. cit.*) utilized the number of femoral pores and the number of lamellae beneath the fourth toe. That an average difference does occur in these characters can not be denied, but they prove utterly useless in diagnosing the various forms. Only in *leptophrys* which has an extremely high femoral pore count does it seem to be characteristic.

The nature of the granules surrounding the enlarged supraocular plates may eventually prove of considerable usefulness. Hartweg and Oliver (*op. cit.*: 3–7, fig. 2) utilized the character with success in diagnosing several forms of *Cnemidophorus*, and in *parva* and *leptophrys* I have found that there is a marked tendency for the posterior supraocular scale to be more completely separated from the superciliaries and the frontoparietals than in other forms.

Three other characters, however, seem less variable than those listed above, and seem to offer features of some phylogenetic import. The first of these is the consistent lack of lateral contact between the postnasals and the prefrontals in *leptophrys*. In all other forms of the group these two scales contact each other between the loreals and the frontonasals on either side. The longitudinal division of the median parietal to produce four instead of three parietals is unique in *chaitzami*. There is, however, a tendency for the posterior head plates of *leptophrys* to divide and the occurrence of a row of azygous scales between the frontal and parietals is not uncommon in this latter.

Dunn (*loc. cit.*) made studies on the dorsal pattern of the group and concluded that it was of little use as a diagnostic character. My own observations do not bear out his conclusions. In studying pattern several difficulties arise: first, there is ontogenetic change in pattern, and, secondly, there is, in some instances, sexual dimorphism in the adult pattern. The juveniles, both male and female, of all forms possess a light brown mid-dorsal area (often with darker mottlings) generally bordered laterally by a narrow light line. Below this line is a very dark stripe, then another narrow white line (often broken into a series of elongate spots) below which the dark ground color continues to the ventrum. The pattern is definitely striped and not unlike that described above for *chaitzami*, and with minor modifications this type of pattern prevails in the adult males and females of *stuarti* and *leptophrys* as well.

In other forms, however, the juvenile pattern gives way to one of vertical light and dark bars in adult males, while in the females of these forms the two patterns seem to intergrade, the vertical bars being plainly evident but the white ones expanded on the side to show definitely the remnants of the juvenile light lateral stripe.

In attempting to arrange the above characters in an effort to determine phylogenetic relationships, several features attract immediate attention.

First is the similarity in the pattern of adult males in three widely-separated forms, *leptophrys, stuarti, and chaitzami.* Second is the tendency of the posterior head scales to break up in *leptophrys* and *chaitzami,* and finally, there is a high femoral pore count, and the contacting loreal and frontonasal in *leptophrys.* Thus starting with the adult pattern as a basis, three forms are readily separable from the others and they show decreasing amounts of differentiation from south to north, *leptophrys* being widely different from *chaitzami* and this latter only slightly different from *stuarti.* Furthermore the somewhat smaller ranges of these three is suggestive of a relict condition, a suspicion strengthened by the lack of intergrades between *pulchra* or *parva* and *leptophrys* and the fact that *chaitzami* retains its identity though occurring in the same habitat with *hartwegi.* I have examined, however, what I believe to be intergrades between *stuarti* and *hartwegi* from Tabasco.

The remaining forms of the group—all those with the barred pattern in adult males—are poorly differentiated. The transition between them is probably broad (Alta Verapaz, Guatemala to northwestern Honduras in *pulchra* and *hartwegi*) and except in the case of *stuarti* and *hartwegi* they show no tendency to intergrade with the striped types. There is, however, some similarity between *parva* and *leptophrys* in the complete isolation of the third supraocular from the superciliaries and the frontoparietals.

It is evident from the above that we may be dealing with two groups, one (*leptophrys, stuarti,* and *chaitzami*) much older, well differentiated, and now possessing smaller ranges, the other made up of little more than incipient races, extremely variable, and actively evolving. Between these two only the *stuarti-hartwegi* intergrades present a connecting link. Further exploration in the south may, however, reveal populations intermediate between *leptophrys* and either *pulchra* or *parva* or both. For the present I am unable to draw any definite conclusions and I offer the above as a mere statement of the problem with some of its more suggestive approaches.

Key to the Undulata Group of Ameiva.

A. Posterior nasals separated from prefrontals by frontonasal ..... *leptophrys*

AA. Posterior nasals in contact with prefrontals ..... B

B. Median gulars abruptly enlarged C

C. Enlarged medial gulars arranged in a single longitudinal series ..... D

D. Four parietal plates ..... *chaitzami*

DD. Three parietal plates ..... *stuarti*

CC. Enlarged median gulars more or less irregularly arranged ..... E

E. Two rows of granules between third supraoculars and superciliaries; third supraoculars generally completely separated from frontoparietals by granules ..... *parva*

EE. A single row of granules between third supraoculars and superciliaries; third supra-

oculars in contact with frontoparietals anteriorly.....F

F. Preanals in a single longitudinal row (Tehuantepec) or a single, large, central preanal followed by a smaller one on either side (Colima); rarely arranged in 2 longitudinal rows.....*undulata*

FF. Preanals in two longitudinal rows.....*pulchra*

BB. Median gulars enlarged but grading gradually into smaller surrounding throat scales.....*hartwegi*

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